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September 16, 1993

Mr. William C. Lockett, Chief
Office of External Affairs
California Air Resources Board
2020 L Street
Sacramento, California 95814

Dear Bill:

The Scientific Review Panel on Toxic Air Contaminants has reviewed the Report on Acetaldehyde and has formulated its findings regarding the report. I am formally submitting the Scientific Review Panel's findings to the Air Resources Board.

Sincerely,

A handwritten signature in cursive script, reading "James N. Pitts, Jr.".

Dr. James N. Pitts, Jr.
Chair, Scientific Review Panel

Enclosure

cc: Scientific Review Panel

Findings of the Scientific Review Panel on
THE REPORT ON ACETALDEHYDE
As Adopted from the Panel's May 12, 1993 Meeting

Pursuant to Health and Safety Code section 39661, the Scientific Review Panel (SRP) has reviewed the report "Acetaldehyde as a Toxic Air Contaminant" prepared by the staffs of the Air Resources Board (ARB) and the Office of Environmental Health Hazard Assessment (OEHHA) on the public exposure to, and health effects of acetaldehyde. The Panel also reviewed the public comments received on this report. Based on this review, the SRP makes the following findings also pursuant to Health and Safety Code section 39661:

1. Acetaldehyde was declared a toxic air contaminant by the Air Resources Board on April 8, 1993.
2. There is evidence that exposure to acetaldehyde results in animal carcinogenicity and therefore has the potential for human carcinogenicity. The International Agency for Research on Cancer (IARC) classified "acetaldehyde as a possible human carcinogen (2B) based on sufficient evidence in animals and inadequate evidence in humans." The United States Environmental Protection Agency (U.S. EPA) classified acetaldehyde "as a probable human carcinogen (B2) on the basis of sufficient evidence for carcinogenicity in animals and inadequate evidence in humans."
3. Based on available scientific information, a level of acetaldehyde exposure below which no carcinogenic effects are anticipated cannot be identified.
4. Based on a health protective interpretation of available scientific evidence, the upper 95 percent confidence limits on the potential lifetime risk of cancer from acetaldehyde at ambient concentrations range from 0.97 to 27.0×10^{-6} per part per billion (0.54 to 15.0×10^{-6} per microgram per cubic meter). Furthermore, based on available scientific evidence, 4.8×10^{-6} per part per billion (2.7×10^{-6} per microgram per cubic meter) is the best value of the upper confidence limit of risk. Table I compares the best value of the upper bound acetaldehyde potential unit cancer risk with those of other compounds reviewed by the SRP. These 95 percent upper confidence limits for excess lifetime risks are health-protective estimates; the actual risk may be significantly lower.

5. The range of risk values represents several sources of uncertainty. They include uncertainty due to the small number of animals used in the bioassay, the choice of the animal to human scaling factors, and the choice of the extrapolation model.
6. The major identified sources of ambient outdoor acetaldehyde are direct emissions from mobile sources, fuel combustion, burning, wildfires, oil refineries, and secondary formation by photochemical reactions.
7. The addition of methanol and methyl tert-butyl ether (MTBE) to fuel does not increase acetaldehyde emissions. Alternate fuels containing the oxygenate additives ethanol or ethyl tert-butyl ether (ETBE), upon combustion, result in acetaldehyde emissions. However, it is not known to what extent ethanol or ETBE will be used as a winter oxygenate in California fuels, and therefore the resulting affect on acetaldehyde emissions.
8. One of the main products of the photooxidation of acetaldehyde is peroxyacetyl nitrate (PAN). Airborne acetaldehyde in the presence of nitrogen oxides can be converted to PAN which is a strong eye irritant and plant toxicant.
9. Based on data collected by the ARB's ambient toxic air contaminant monitoring network, the estimated mean annual population-weighted outdoor ambient exposure for approximately 20 million Californians is 2.3 parts per billion in volume (4.1 micrograms per cubic meter).
10. "Hot spot" exposure may increase the potential cancer risk to individuals living near large combustion sources. Acetaldehyde emissions and risk information are being submitted by facilities subject to the AB 2588 Air Toxics "Hot Spots" reporting program (Chapter 1252, Statutes of 1987, Health and Safety Code section 44300 et seq.). This information will be used during the risk management phase to help determine priority and need for control of sources emitting acetaldehyde.
11. Based on its gas-phase reactivity from photolysis and oxidation by the hydroxyl radical, acetaldehyde's estimated tropospheric lifetime is calculated to be approximately 12 hours under average meteorological conditions.
12. Results from indoor monitoring of acetaldehyde in California's homes, offices, and public buildings indicate that people are exposed frequently to higher indoor concentrations than outdoor acetaldehyde concentrations due to the abundance of combustion sources and consumer products in buildings that emit acetaldehyde. The results of surveys indicate that acetaldehyde concentrations inside California residences

generally range from less than 1 part per billion (1.8 micrograms per cubic meter) to 35 parts per billion (63 micrograms per cubic meter). Mean concentrations can range from 1 part per billion in office and public buildings to 113 parts per billion (203 micrograms per cubic meter) for a smoke filled tavern, with approximately 10 parts per billion (18 micrograms per cubic meter) found in conventional homes.

13. A number of acute adverse health effects are associated with acetaldehyde exposure. Such effects include irritation of the skin, eyes and mucous membranes, as well as nausea and headaches. Skin contact with acetaldehyde can induce long-term allergic dermal sensitization, and limited evidence suggests that inhalation of high concentrations of acetaldehyde can cause respiratory tract sensitization. Adverse health effects other than cancer are not expected to occur at mean statewide outdoor ambient concentrations. However, there is evidence that adverse acute health effects may result from exposure to levels found in indoor environments for those sensitive to acetaldehyde.
14. Long-term or chronic exposure has been shown to damage the respiratory tracts of rats. Using standard methodology to calculate a Reference Exposure Level (REL) produces a daily chronic REL of 5 parts per billion (9 micrograms per cubic meter).
15. The staffs of the ARB and OEHHA have developed a risk assessment based on relative exposure to outdoor concentrations. Using the OEHHA staff's best value for unit cancer risk of 4.8×10^{-6} parts per billion volume, and the corresponding concentrations found in outdoor environments, the number of excess cancer cases due to outdoor exposure to acetaldehyde is estimated to be approximately 10 per million, for a 70 year lifetime. This corresponds to an excess cancer burden of 288 for outdoor exposures for a California population of 30 million.

I certify that the above is a true and correct copy of the findings adopted by the Scientific Review Panel on May 12, 1993.



Dr. James N. Pitts, Jr.
Chairman, SRP